Canyon Area

The Grand Canyon of the Yellowstone

The Grand Canyon of the Yellowstone is roughly 20 miles long, measured from the Upper Falls to the Tower Fall area, and is 800 to 1,200 feet deep and 1,500 to 4,000 feet wide. The canyon as we know it today is a very recent geologic feature, no more than 10,000 to 14,000 years old, although there has probably been a canyon in this location for a much longer period. The exact sequence of events in the formation of the canyon is not well understood, and the few studies that are available are thought to be inaccurate.

The canyon was formed by erosion rather than by glaciation. After the caldera eruption of about 630,000 years ago, the area was covered by a series of lava flows. The area was also faulted by the doming action of the caldera before the eruption. The site of the present canyon, as well as any previous canyons, was probably the result of this faulting, which allowed erosion to proceed at an accelerated rate. The area was also covered by the glaciers that followed the volcanic activity. Glacial deposits probably filled the canyon at one time but have since been eroded away, leaving little or no evidence of their presence. The canyon is still being eroded by the Yellowstone River today.

The canyon below the Lower Falls was at one time the site of a geyser basin that was the result of rhyolite lava flows, extensive faulting, and heat beneath the surface (related to the hot spot). No one is sure when the geyser basin was formed in the area, although it was probably present at the time of the last glaciation. The chemical and heat action of the geyser basin caused the rhyolite rock to become hydrothermally altered, making it very soft and brittle and more easily erodible. Evidence of this thermal activity exists in the canyon in the form of geysers and hot springs that are still active and visible. The Clear Lake area south of the canyon is probably also a remnant of this activity (Clear Lake is fed by hot springs).

At the end of the last glacial period (about 14,000 to 18,000 years ago) ice dams formed at the mouth of Yellowstone Lake. When the ice dams melted, a great volume of water was released downstream causing massive flash floods and immediate and catastrophic erosion of the present-day canyon. These flash floods probably happened more than once. The canyon is a classic V-shaped valley, indicative of river-type erosion rather than glaciation.

The falls are erosional features formed by the Yellowstone River as it flows over progressively softer, less resistant rock. The first falls, Upper Falls, is 109 feet high; it can be seen from the Brink of the Upper Falls Trail and from Uncle Tom's Trail. The Lower Falls is 308 feet high and can be seen from Lookout Point, Red Rock Point, Artist Point, Brink of the Lower Falls Trail, and from various points along the South Rim Trail. The Lower Falls is often described as being more than twice the size of Niagara, although this only refers to its height and not the volume of water flowing over it. The volume of water flowing over the falls can vary from 63,500 gal/sec at peak runoff to 5,000 gal/sec in the fall. Athird falls can be found in the canyon between the Upper and Lower falls. Crystal Falls is the outfall of Cascade Creek into the canyon; it can be seen from the South Rim Trail just east of the Uncle Tom's area.

The colors in the canyon are a result of hydrothermal alteration. The rhyolite in the canyon contains a variety of different iron compounds. When the old geyser basin was active, the "cooking" of the rock caused chemical alterations in these iron compounds. Exposure to the elements caused the rocks to change colors. The rocks are, in effect, oxidizing, or, in layman's terms, the canyon is rusting. The colors indicate the presence or absence of water in the individual iron compounds. Most of the yellows in the canyon are the result of iron present in the rock rather than sulfur, as many people think.

One of the canyon's more popular wildlife attractions is the osprey. These large, black and white birds arrive at the canyon in late April and early May. Their nests can be clearly observed, using a spotting scope, from Grandview, Lookout, and Artist points. There are normally at least three or four active nests visible from these points, giving visitors a rare chance to look down into the nests without disturbing the birds.

Hayden Valley

The Yellowstone River flows through Hayden Valley between Yellowstone Lake and the Grand Canyon of the Yellowstone. The valley was once filled by an arm of Yellowstone Lake and, consequently, contains fine-grained lake sediments that are now covered with glacial till left from the most recent glacial retreat 13,000 years ago. Because the glacial till contains many different grain sizes, including clay and a thin layer of lake sediments, water cannot percolate readily into the ground. This is why the Hayden Valley is marshy and has little encroachment of trees.

Hayden Valley is one of the best places in the park to view a wide variety of wildlife. It is an excellent place to look for grizzly bears, particularly in the spring and early summer when they may be preying upon newborn bison and elk calves. Large herds of bison may be viewed in the spring, early summer, and during the fall rut, which usually begins late July to early August. Coyotes can almost always be seen in the valley.

Bird life is abundant in and along the river. Avariety of shore birds may be seen in the mud flats at Alum Creek. Apair of sandhill cranes usually nests at the south end of the valley. Ducks, geese, and American white pelicans cruise the river. The valley is also an excellent place to look for bald eagles and northern harriers. Great gray owls can sometimes be seen swooping across the meadows in search of food (these birds are especially sensitive to human disturbance).

Mt. Washburn

Mt. Washburn, named for Gen. Henry Dana Washburn, leader of the 1870 Washburn-Langford-Doane Expedition, is the main peak in the Washburn Range. It rises 10,243 ft. above the west side of the canyon. It is the remnant of volcanic activity that took place long before the formation of the present canyon. It is an excellent example of subalpine habitat and is very accessible to the average visitor. Bighorn sheep and an abundance of wildflowers can be found on its slopes in the summer, and black and grizzly bears are sometimes seen here.

Day Hiking Trails

Canyon Rims: There are numerous trails and viewpoints of the canyon falls, both from the north and south rim. A guide to the Canyon Rim trails is available at numerous locations along the rim.

Mary Mountain Trail: This 21-mile (one way) trail climbs gradually up over Mary Mountain and the park's Central Plateau to the Nez Perce trailhead between Madison and Old Faithful. Elk and bison can sometimes be seen in the distant meadows. The trail through Hayden Valley is often difficult to follow as bison regularly knock down the trail markers. The trailhead is north of Alum Creek pullout, 4 miles south of Canyon Junction. The level of difficulty rating for this trail is "moderately strenuous" due to its length.

Howard Eaton Trail: This moderately easy 3- to 12-mile (one way) hike has little vertical rise and will take 2 to 8 hours, depending on how far you go. It passes through forest, meadow, and marshland to Cascade Lake (3 miles), Grebe Lake (4-1/4 miles), Wolf Lake (6-1/4 miles), Ice Lake (8-1/4 miles), and Norris Campground (12 miles). Most years, this trail remains very wet and muddy through July. Insects can also be very annoying. The trailhead is 1/2 mile west of Canyon Junction on the Norris-Canyon Road.

Cascade Lake: This easy 5-mile (round trip) hike takes 3 hours and is an enjoyable walk for those with limited time. The trail passes through open meadows and over small creeks. Look for wildlife and wildflowers in season. Most years, this trail remains very wet and muddy through July. The trailhead is at the Cascade Lake Picnic Area, 1-1/2 miles north of Canyon Junction on the Tower-Canyon Road.

Observation Peak: Hike to Cascade Lake from either of two trailheads. From the lake, the strenuous, 1,400 foot climb (in 3 miles) will take roughly 3 hours. The 11-mile (round trip) hike takes you to a high mountain peak for an outstanding view of the Yellowstone wilderness. The trail passes through open meadows and some whitebark pine forests. Past Cascade Lake, there is no water available along the trail. This hike is not recommended for persons with heart and/or respiratory problems. One trailhead is located in the Cascade Lake Picnic Area, 1-1/2 miles north of Canyon

Junction on the Tower-Canyon Road. The other is accessed from a pullout 1/4 mile west of Canyon on the Norris-Canyon Road.

Grebe Lake: There is little vertical rise on this moderately easy 3-4 hour, 6-mile (round trip) hike. The trail follows an old fire road through meadows and forest, some of which burned during the fires of 1988. Once at the lake you can connect with the Howard Eaton Trail. The trailhead is 3-1/2 miles west of Canyon Junction on the Norris-Canyon Road.

Seven Mile Hole: This strenuous 11-mile (round trip) hike takes 6-8 hours to complete. Following the Canyon Rim for the first 1-1/2 miles, you will be rewarded with views of Silver Cord Cascade. Continue north another 1/2 mile where you join the Washburn Spur Trail; after another 3 miles, the trail drops off to Seven Mile Hole, a 1-1/2 mile, 1,400 foot drop. Hike it carefully, watch your footing, and conserve your energy. Depending on your condition and the weather, it can be a long hike back out. Be especially careful where the trail passes both dormant and active hot springs. Off-trail travel is prohibited. This trail is not recommended for persons with heart and/or respiratory problems. The trailhead for the hike is the Glacial Boulder Trailhead on Inspiration Point Road.

Washburn Trail/Washburn Spur Trail: This 11-1/2 -mile (one way) hike begins at the Dunraven Pass trailhead, ascends Mount Washburn, and ends at the Glacial Boulder on Inspiration Point Road. This strenuous hike takes 6-8 hours to complete. Starting at the Washburn Trailhead at Dunraven Pass, you ascend Mt. Washburn and may see wildflowers (in season) and bighorn sheep as well as spectacular views. After this three-mile ascent, the Washburn Spur Trail descends very steeply from the east side of the Fire Lookout to Washburn Hot Springs in 3.7 miles. Here you will find some interesting thermal features, including mud pots. Continue past the turnoff to Seven Mile Hole and follow the trail to the Glacial Boulder and the Canyon area. This trail is not recommended for persons with heart and/or respiratory problems. The Washburn Trailhead at Dunraven Pass is 4-1/2 miles north of Canyon Junction.

Lake Area

Yellowstone Lake

Yellowstone Lake is the largest natural freshwater lake at high elevation (7,733 feet) in North America. The lake covers 136 square miles and is 20 miles long by 14 miles wide. It has 110 miles of shoreline. The deepest point in the lake is measured at 390 feet, and it has an average depth of 140 feet. While in a stunning setting with the Absaroka Mountains as a backdrop to the east, the lake has not always been so peaceful. There is geologic evidence that large volcanic eruptions have occurred in Yellowstone approximately every 600,000 years. The most recent of these (630,000 years ago) erupted from two large vents, one near Old Faithful (the Mallard Lake Dome) and one just north of Fishing Bridge (the Sour Creek Dome). Ash from this huge explosion, 1,000 times the size of Mt. St. Helens, has been found all across the continent. The magma chamber then collapsed, forming a large caldera that was partially filled by subsequent lava flows. The caldera includes the basin of Yellowstone Lake. The original lake was 200 feet higher than the present-day lake, extending northward across Hayden Valley to the base of Mt. Washburn.

It is thought that Yellowstone Lake originally drained south into the Pacific Ocean via the Snake River. The lake currently drains north from its outlet, the Yellowstone River, at Fishing Bridge. The elevation of the lake's north end does not drop substantially until LeHardy Rapids. Therefore, this spot is considered the actual northern boundary of Yellowstone Lake.

In the last decade, geological research has determined that the two volcanic vents, now known as "resurgent domes," are rising again. From year to year, they either rise or fall, with an average net uplift of about one inch per year. During the period between 1923 and 1985, the Sour Creek Dome was rising. In the years since 1986, it has either declined or remained the same. The resurgence of the Sour Creek dome is causing Yellowstone Lake to "tilt" southward. Larger sandy beaches can now be found on the north shore of the lake, and flooded areas can be found in the southern arms.

Research using a small submersible robot submarine has revolutionized our understanding of Yellowstone Lake. We now know that the bottom of the lake looks similar to the land surface in Yellowstone, with geysers, hot springs, fumaroles, and deep canyons. The deepest spot in the lake

(390 feet) was measured in a canyon just east of Stevenson Island; previously, the deepest spot (320 feet) had been measured in West Thumb. The following excerpt, which is from a report published in *Yellowstone Science* (v. 8, No. 1), explains the findings from 1999 exploration.

> Recently completed high-resolution surveys of the northern part of Yellowstone Lake show a lake bottom covered with dozens of circular depressions and hundreds of spires and pinnacles protruding from the floor. The circular depressions are 25–800 meters in diameter, have steep inner walls, and may be the remnants of explosive events similar to explosion craters exposed on nearby land. The spires are composed primarily of silica, up to 35 meters high and up to 50 meters in diameter. They occur singularly, in clusters, and in north-south-trending lines up to 400 meters long. These linear features may sit astride fissures on the lake floor. In many areas, spires occur around the margins of circular depressions. In at least one case, spire development appears to have both preceded and followed formation of a circular depression.
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> Formation of both spires and circular depressions is related to deep-seated fluid circulation, and occurred over the past 12,000 years. Explosions such as those responsible for these craters result from the transformation of water to steam, often due to changes in confining pressure that result from (and accelerate) failure and fragmentation of overlying cap rock (hydrofracturing). Venting processes similar to those that form black smoker chimneys on the ocean floor form the spires in Yellowstone Lake.

Members of the 1870 Washburn party noted that Yellowstone Lake was shaped like "a human hand with the fingers extended and spread apart as much as possible." The large southwestern bay represents the thumb of the hand. Through the years, other names have been applied to this feature, including "West Arm" and "West Bay," but "West Thumb" remains the accepted name. The West Thumb of Yellowstone Lake was formed by a large volcanic explosion that occurred approximately 150,000 years ago. The resulting collapsed volcano (caldera) later filled with water forming an extension of Yellowstone Lake. The West Thumb is about the same size as another famous volcanic caldera, Crater Lake in Oregon. It is interesting to note that West Thumb is a caldera within a caldera, the Yellowstone caldera that formed 630,000 years ago.

During late summer, Yellowstone Lake becomes thermally stratified with each of several water layers having a different temperature. The topmost layer rarely exceeds 66°F, and the lower layers are much colder. Because of the extremely cold water, survival time for anyone who goes into the lake is estimated to be only 20 to 30 minutes.

In winter, ice thickens on Yellowstone Lake, and it varies from a few inches to more than two feet. The lake's basin has an estimated capacity of 12,095,264 acre-feet of water. Because its annual outflow is about 1,100,000 acre-feet, the lake's water is completely replaced only about every eight to ten years. Since 1952, the annual water level fluctuation has been less than six feet.

There is an abundance and diversity of wildlife in this area that attracts many visitors. The lake is home to the largest population of wild Yellowstone cutthroat trout in North America, which are now threatened by illegally introduced lake trout. The area around the lake is prime grizzly bear habitat. The Fishing Bridge area, including Pelican Valley to the north and east, is especially significant ecologically to bears and other wildlife because lake, river, and terrestrial ecosystems merge here to create a diverse natural complex unique both inside and outside the park. There are numerous trout spawning streams in the area that are used by bears in the spring and early summer. Hayden Valley is known for the herds of bison that graze there. During the rut, in August, traffic can be stopped for hours by huge herds of milling bison. During the winter, Pelican Valley is another outstanding place to view bison. While river otters are quite elusive, they are seen with some regularity at the Bridge Bay Marina during the summer. American white pelicans, bald eagles, and osprey are commonly seen in the Lake area.

The Lake Yellowstone Hotel, situated on the northwestern shore of the lake, is the oldest visitor facility still remaining in the park. It was built in 1891 on a site long known as a meeting place for Native Americans, trappers, and mountain men. At the time it was built, the building was not particularly distinctive, resembling any other railroad hotel financed by the Northern Pacific Railroad. But in 1903, the architect of the Old Faithful Inn, Robert Reamer, masterminded the renovation of the hotel, designing the ionic columns, extending the roof in three places, and adding the 15 false balconies, which prompted it to be known for several years as the "Lake Colonial Hotel." A num-

ber of additional changes by 1929, including the addition of the dining room, porte-cochere (portico), and sunroom, as well as the refurbishing of the interior created the gracious landmark we see today. But, by the 1970s, the hotel had fallen into serious disrepair. In 1981, the National Park Service and the park concessioner embarked on a ten-year project to restore the Lake Hotel in appearance to its days of glory in the 1920s. The work was finished in time for the celebration of the hotel's centennial in 1991. The hotel was placed on the National Register of Historic Places that year.

Yellowstone River

The Yellowstone River is the last major undammed river in the lower 48 states, flowing 671 miles from its source southeast of Yellowstone National Park to the Missouri River. The river begins in the Absaroka Mountain Range on Yount Peak and flows through the Thorofare region into Yellowstone Lake. It leaves the lake at Fishing Bridge and flows north over LeHardy Rapids and through Hayden Valley. After this peaceful stretch, the river crashes over the Upper and Lower falls of the Grand Canyon. It then flows generally northwest, meeting its largest tributary, the Lamar River, at Tower Junction. The river continues through the Black Canyon and leaves the park near Gardiner, Montana. The Yellowstone River continues north and east through the state of Montana and joins the Missouri River just over the North Dakota state line.

The original Fishing Bridge was built at the lake's outlet in 1902. It was a rough-hewn corduroy log bridge with a slightly different alignment than the current bridge. The existing bridge was built in 1937. The Fishing Bridge, situated over a cutthroat trout spawning area, was historically a tremendously popular place to fish, but was closed to fishing in 1973. Since that time, the bridge has become a popular place to observe fish.

Another popular spot to view fish is LeHardy Rapids, a cascade on the Yellowstone River three miles north of Fishing Bridge. In the spring, many cutthroat trout can be seen here, resting in the shallow pools before expending bursts of energy to leap up the rapids on the their way to spawn under Fishing Bridge. The rapids were named for Paul LeHardy, a civilian topographer with the Jones Expedition in 1873. Jones and a partner started off on a raft with the intent of surveying the river, planning to meet the rest of their party at the Lower Falls. Upon hitting the rapids, the raft capsized, and many of the supplies were lost, including guns, bedding, and food. LeHardy and his partner saved what they could and continued their journey to the falls on foot.

The rapids—and the leaping cutthroat trout—became a popular visitor attraction when a boardwalk was built in 1984 providing access to the area. Due to increased visitation, a group of harlequin ducks, which once frequented this area in spring, have not been seen for several years. The boardwalk has consequently been closed in early spring to protect this sensitive habitat, but the harlequins have not returned.

Mud Volcano/Sulphur Caldron

When the Washburn Expedition explored the area in 1870, Nathaniel Langford described Mud Volcano as "greatest marvel we have yet met with." Although the Mud Volcano can no longer be heard from a mile away (as it could then) nor does it throw mud from its massive crater, the area is still eerily intriguing. Ashort loop trail from the parking lot passes the Dragon's Mouth and the Mud Volcano and is handicapped accessible. The half-mile upper loop trail via Sour Lake and the Black Dragon's Caldron is relatively steep. Aself-guiding trail brochure is available at the beginning of the boardwalk.

The thermal features at Mud Volcano and Sulphur Caldron are primarily mud pots and fumaroles. Fumaroles or "steam vents" occur when the ground water boils away faster than it can be recharged. Hydrogen sulfide gas is present deep in the earth at Mud Volcano. As this gas combines with water and the sulfur is metabolized by cyanobacteria, a solution of sulfuric acid is formed that dissolves the surface soils to create pools and cones of clay and mud. Along with hydrogen sulfide, steam, carbon dioxide, and other gases explode through the layers of mud. The Sulphur Caldron is among the most acidic springs in the park with a pH of 1.3.

Aseries of shallow earthquakes associated with the volcanic activity in Yellowstone struck this area in 1978. Soil temperatures increased to nearly 200° F (93° C). The slope between Sizzling

Basin and Mud Geyser, once covered with green grass and trees, became a barren landscape of fallen trees known as "the cooking hillside." In January 1995, a new feature on the south bank of Mud Geyser became active. It covers an area of 20 by 8 feet and is comprised of fumaroles, small pools, and frying-pan type features. Much of the hillside to the south and southwest of Mud Geyser is steaming and hissing with a few mudpots intermixed.

Two of the most popular features in the Mud Volcano area are the Dragon's Mouth and the Black Dragon's Caldron. The rhythmic belching of steam and the flashing tongue of water give the Dragon's Mouth Spring its name, though its activity has decreased notably since December 1994. The Black Dragon's Caldron exploded onto the landscape in 1948, blowing trees out by their roots and covering the surrounding forest with mud.

Day Hiking Trails

Pelican Creek Trail: This short (1 mile) and easy trail is diverse as it passes through a forest to the lakeshore before looping back across the marsh along Pelican Creek to the trailhead. It is a scenic introduction to a variety of Yellowstone's habitats and a good place for birding. The trailhead is at the west end of the Pelican Creek Bridge, 1 mile east of Fishing Bridge Visitor Center.

Natural Bridge Trail: The natural bridge is a 51-foot cliff of rhyolite rock that has been cut through by the erosional forces of Bridge Creek. The easy 4-mile (round trip) trail from the campground meanders through the forest for 1.2 mile. It then joins the Natural Bridge service road and continues to the right (west) for 1 mile before reaching the Natural Bridge. The short but steep switchback trail to the top of the bridge starts in front of the interpretive exhibit panel. To protect this fragile resource, the top of the bridge is closed to hiking. The trail to the bridge begins just south of the Bridge Bay Marina parking lot near the campground entrance road. The Natural Bridge service road, which begins 1/4 mile south of the Bridge Bay junction, is open to bicyclists and hikers. The trail is closed from late spring to early summer due to bears feeding on spawning trout in Bridge Creek. Inquire at the Visitor Center about trail closures before hiking or bicycling these trails.

Storm Point Trail: This easy, 2-mile loop trail begins in the open meadows overlooking Indian Pond and Yellowstone Lake. The trail passes by the pond before turning right (west) into the forest. It continues through the trees and out to scenic, windswept Storm Point. The rocky area near the point is home to a large colony of yellow-bellied marmots. Following the shoreline to the west, the trail eventually loops through the lodgepole pine forest and returns to Indian Pond. The trailhead is at the Indian Pond pullout, 3 miles east of Fishing Bridge Visitor Center.

Elephant Back Mountain Trail: This moderately strenuous 3-mile long trail climbs 800 feet in 1-1/2 miles through a dense lodgepole pine forest. After a mile, the trail splits into a loop. The left fork is the shortest and least steep route to the top. The overlook provides a sweeping panoramic view of Yellowstone Lake and the surrounding area. The trailhead is at the pullout that is 1 mile south of Fishing Bridge Junction.

Howard Eaton Trail: This easy, 7-mile (round trip) trail begins at the east side of Fishing Bridge and follows the Yellowstone River for a short distance before joining a service road; the trail continues on the road for 1/4 mile. Leaving the road, the trail meanders for 3 miles through meadow, forest, and sagebrush flats with frequent views of the river. Wildlife and waterfowl are commonly seen here. The last mile passes through a dense lodgepole pine forest before reaching an overview of LeHardy Rapids. To return, follow the same trail back to the trailhead. The trail does continue on for another 12 miles to the South Rim Drive at Canyon, but is not well maintained. This trip would require planning for a full day's hike and a return ride to the trailhead. This area is good grizzly bear habitat, and the trail is closed when bears are known to be in the area. Inquire at the Visitor Center before hiking.

Avalanche Peak Trail: This strenuous, 5-mile (round trip) trail climbs steeply (1,800 feet in 2-1/2 miles) without the benefit of switchbacks. It passes through the forest and into an old avalanche slide area. It continues through the whitebark pine forest to a small meadow at the base of the bowl of Avalanche Peak, affording some of the best panoramic views in the park. The trail continues up a scree slope along the narrow ridgeline of Avalanche Peak. An unmarked trail drops down the northeast side of the bowl and returns to the meadow. Since whitebark pine cones are a favored

food of grizzly bears in the fall, avoid this trail at that time. The trial begins at the west end of Eleanor Lake across the road to the east of the small creek.

Pelican Valley Trail: This moderately difficult 6-mile (round trip) trail winds through the Pelican Valley providing views of the broad open valley and forest, some of the best grizzly habitat in the lower 48 states. The turn-around point is a footbridge, however, the trail continues on through the valley. Due to grizzly bears in the area, the trail is not open until July 4th, and then it is recommended (not required) for use by groups of four people or more. The trailhead is at the end of a dirt road that is 3 miles east of Fishing Bridge Visitor Center and across the road from Indian Pond.

Grant/West Thumb Area

West Thumb Geyser Basin

The West Thumb Geyser Basin, including Potts Basin to the north, is the largest geyser basin on the shores of Yellowstone Lake. The heat source of the thermal features in this location is thought to be relatively close to the surface, only 10,000 feet down! The thermal features at West Thumb are found not only on the lake shore, but also extend under the surface of the lake. Several underwater geysers were discovered in the early 1990s and can be seen as slick spots or slight bulges in the summer. During the winter, the underwater thermal features are visible as melt holes in the icy surface of the lake. River otters are commonly seen along the thermally melted areas of the lake during the winter months, along with coyotes, bison, and ravens.

The 1869 Folsom-Cook-Peterson Expedition visited the West Thumb Geyser Basin, and David Folsom described the area as follows:

Among these were springs differing from any we had previously seen. They were situated along the shore for a distance of two miles, extending back from it about five hundred yards and into the lake perhaps as many feet. There were several hundred springs here, varying in size from miniature fountains to pools or wells seventy-five feet in diameter and of great depth. The water had a pale violet tinge, and was very clear, enabling us to discern small objects fifty or sixty feet below the surface. Asmall cluster of mud springs near by claimed our attention. These were filled with mud, resembling thick paint of the finest quality, differing in color from pure white to the various shades of yellow, pink, red and violet. During the afternoon they threw mud to the height of fifteen feet. . .

Historically, visitors traveling to Yellowstone would arrive at West Thumb via stagecoach from the Old Faithful area. At West Thumb, they had the choice of continuing on the dusty, bumpy stagecoach or boarding the steamship “Zillah” to continue the journey by water to the Lake Hotel. The boat dock was located near the south end of the geyser basin near Lakeside Spring.

Fishing Cone is a hot spring located in the West Thumb Geyser Basin. The Folsom party probably saw it in 1869, but the first recorded description of Fishing Cone comes from the 1870 Washburn Expedition. Party member Walter Trumball wrote about Cornelius Hedges’ experience fishing:

Agentleman was fishing from one of the narrow isthmuses or shelves of rock, which divided one of these hot springs from the [Yellowstone] lake, when, in swinging a trout ashore, it accidentally got off the hook and fell into the spring. For a moment it darted about with wonderful rapidity, as if seeking an outlet. Then it came to the top, dead, and literally boiled.

From that time on, visitor after visitor performed this feat, catching fish from the cold lake and cooking them on the hook. For years, park Superintendent P.W. Norris (1877-1882) demonstrated it to incredulous tourists. Anational magazine reported in 1903 that no visit to the park was complete without this experience, and tourists often dressed in a cook’s hat and apron to have their pictures taken at Fishing Cone. Fishing at the cone can be dangerous and is today prohibited. A known geyser, Fishing Cone erupted frequently to the height of 40 feet in 1919 and to lesser heights in 1939. One fisherman was badly burned in Fishing Cone in 1921.

Heart Lake

Lying in the Snake River watershed east of Lewis Lake and south of Yellowstone Lake, Heart Lake was named sometime before 1871 for Hart Hunney, an early hunter. Other early explorers in the region incorrectly assumed that the lake's name was spelled "Heart" because of its shape, and that is the spelling that has persisted.

The small range of mountains located just west of Heart Lake, the Red Mountains, is completely contained within the boundaries of Yellowstone National Park. In 1871, F.V. Hayden named present-day Mount Sheridan "Red Mountain." In 1872, members of the second Hayden Survey transferred that name to the entire range. In 1878, Henry Gannett reported that there were 12 peaks in the range, with 10,308-foot Mount Sheridan being the highest.

Factory Hill is a 9,607-foot peak in the Red Mountains so named because of an 1871 description by N.P. Langford of the steam vents near the mountain: "Through the hazy atmosphere we beheld, on the shore of the inlet opposite our camp, the steam ascending in jets from more than fifty craters, giving it much the appearance of a New England factory village."

Craig Pass

Craig Pass, at 8,262 feet on the Continental Divide, is about eight miles east of Old Faithful on the Grand Loop Road. In 1891, U.S. Army Corps of Engineers Captain Hiram Chittenden discovered Craig Pass while he was surveying for the first road between Old Faithful and West Thumb. It was probably Chittenden who named the pass for Ida M. Craig (Wilcox), "the first tourist to cross the pass" on Chittenden's new road, on about September 10, 1891.

Isa Lake is at the pass and was also named by Chittenden. Isa Lake is noteworthy as probably the only lake on earth that drains naturally to two oceans backwards, the east side draining to the Pacific and the west side to the Atlantic.

Shoshone Lake

Shoshone Lake, the park's second largest lake, is located at the head of the Lewis River southwest of West Thumb. It is possible that fur trapper Jim Bridger visited this lake in 1833, and fellow trapper Osborne Russell certainly reached the lake in 1839. In 1863, prospector Walter DeLacy visited the lake and named it "DeLacy's Lake." The lake was also called "Madison Lake" because it was erroneously thought to be the head of the Madison River. Cornelius Hedges of the 1870 Washburn Expedition named the lake after the party's leader, Gen. H.D. Washburn. In 1872, Frank Bradley of the second Hayden Survey gave the lake another—final—name: "Upon crossing the divide to the larger lake, we found it to belong to the Snake River drainage, and therefore called it Shoshone Lake, adopting the Indian name of the Snake [River]."

Shoshone Lake is 205 feet at its maximum depth, has an area of 8,050 acres, and contains lake trout, brown trout, and Utah chub. Originally, Shoshone Lake was barren of fish owing to waterfalls on the Lewis River. The two types of trout were planted beginning in 1890, and the Utah chub was apparently introduced by bait fishermen. This large lake is the source of the Lewis River, which flows to the Pacific Ocean via the Snake River system. Shoshone Lake is thought to be the largest lake in the lower 48 states that cannot be reached by road. No motorboats are allowed on the lake.

Snake River

The Snake River is a major tributary of the Columbia River and has its headwaters just inside Yellowstone on the Two Ocean Plateau. The name, which comes from the Snake (Shoshone) Indians, was applied to the river as early as 1812, making it one of the oldest place names in the park. The Snake name comes from sign language—a serpentine movement of the hand with the index finger extended—that referred to the weaving of baskets or grass lodges of the Snake or Shoshone Indians.

The source of the Snake River was debated for a long time. The problem was to find the longest branch in the Two Ocean Plateau, which is thoroughly crisscrossed with streams. Current maps

show the head of the Snake to be about 3 miles north of Phelps Pass, at a point on the Continental Divide inside Yellowstone National Park. Anumber of springs gush forth upon the hillside that is about two miles above sea level. Uniting, they form a small stream, which flows to the Pacific. The Snake River is the nation's fourth largest river; 42 miles of it are in Yellowstone National Park.

Day Hiking Trails

West Thumb Geyser Basin Trail: The trail begins at the West Thumb Geyser Basin parking lot 1/4 mile east of West Thumb Junction. Stroll through a geyser basin of colorful hot springs and dormant lakeshore geysers situated on the scenic shores of Yellowstone Lake. The 3/8 mile (round trip) easy trail and boardwalk are handicapped accessible with assistance (the boardwalk trail has a slight grade as it descends to and climbs up from the lake shore). Atrail guide is available at the beginning of the trail.

Yellowstone Lake Overlook Trail: From the West Thumb Geyser Basin parking lot, cross the road to the west and hike to a high mountain meadow for a commanding view of the West Thumb of Yellowstone Lake and the Absaroka Mountains. The 2-mile (round trip) trail is mostly level terrain with a moderately strenuous 400-foot elevation gain near the overlook.

Duck Lake Trail: On this moderately difficult 1-mile (round trip) hike, you will climb a small hill for a view of Duck and Yellowstone lakes. From here you can see the expanse of the 1988 fires that swept through this area. The trail begins in the West Thumb Geyser Basin parking area.

Shoshone Lake Trail (via DeLacy Creek): The trail follows a forest edge and passes through open meadows to the shores of Yellowstone's largest backcountry lake. Look for wildlife in meadows. The 6-mile (round trip) trial is flat with no steep grades. The trailhead is 8.8 miles east of West Thumb Junction.

Riddle Lake Trail: The level trail crosses the Continental Divide and passes through small mountain meadows and forests to the shores of a picturesque little lake. Look for moose in the marshy meadows and for birds near the lake. Bear Management Area--trail opens July 15. The 5-mile (round trip) trail begins approximately 3 miles south of the Grant Village intersection, just south of the Continental Divide sign.

Lewis River Channel/Shoshone Lake Loop Trail: Get a feel for Yellowstone's backcountry as you hike through a fairly level forested area to the colorful waters of the Lewis River Channel (7 miles round trip). Look for eagles and osprey fishing for trout in the shallow waters. For an all-day hike (11 miles), follow the channel to Shoshone Lake and return via the forested Dogshead Trail. The Lewis River Channel trailhead is approximately 5 miles south of the Grant Village intersection, just north of Lewis Lake on west side of the road.

Old Faithful Area

The Upper Geyser Basin

Yellowstone National Park encompasses nearly 50 percent of the world's geysers. The largest number of geysers in the park are found in the Upper Geyser Basin. Within one square mile, there are at least 150 of these hydrothermal wonders. Five major geysers, Castle, Grand, Daisy, Riverside, and Old Faithful, are predicted regularly by the naturalist staff. There are many frequent, smaller geysers in this basin as well as numerous hot springs and one recently developed mudpot.

The hills surrounding Old Faithful and the Upper Geyser Basin are composed of Quaternary rhyolitic lava flows. These flows, occurring long after the catastrophic caldera eruption of 630,000 years ago, flowed across the landscape like stiff mounds of bread dough due to their high silica content.

Evidence of glacial activity is common in the district. The glacial till deposits underlying the geyser basins provide the storage area for the water necessary for geysers to occur. Many landforms, such as Porcupine Hills north of Fountain Flats, are comprised of glacial gravel and are reminders that as recently as 13,000 years ago, this area was buried under ice.

The Firehole River flows through the Upper, Midway, and Lower geyser basins after originating south of the area on the Madison Plateau. The river is fed by cold springs in its upper reaches. It plunges over the 125-foot Kepler Cascades before reaching the Upper Geyser Basin. The name "Firehole" comes from early trappers in the area who saw all the steam rising from the thermal features surrounding the river and thought it was smoke from fires. Their term for a mountain valley was "hole," and so the river was named. The Firehole River boasts a world-famous reputation for challenging fly-fishing for brown, rainbow, and brook trout.

Thermal basins provide important habitat for wildlife in the Old Faithful District. Bison and elk are found in large numbers here year-round. In the winter, bison and those elk which do not migrate to lower elevations take advantage of the warm ground and thin snow cover. Less frequently seen by visitors are mule deer and moose. During spring and fall, moose are occasionally seen during the early morning or late afternoon. Mule deer are less frequently seen at this elevation, though in past years a small band has been observed wintering in the Upper Geyser Basin. Both black and grizzly bears are seen in the Old Faithful area, especially during the spring when winter-killed carcasses are available. Yellow-bellied marmots are frequently seen near the boardwalk surrounding Old Faithful Geyser. Unfortunately, the colony of marmots here have learned to subsist on human handouts.

There are other wildlife taking advantage of the unique microclimates that the hydrothermal features provide. Cyanobacteria live in the runoff channels of hot springs and geysers, providing food for tiny black ephydrid flies. The flies, in turn, lay their eggs in salmon colored clumps just above the water surface where they are then preyed upon by spiders. Birds, like killdeer, enjoy a feast of ephydrid fly adults as well.

The developed area adjacent to Old Faithful Geyser, which contains many historic structures, has been designated the Old Faithful Historic District. Within the district is the Old Faithful Inn, a National Historic Landmark. Built during the winter of 1903-04, the Inn was designed by Robert C. Reamer, who wanted the asymmetry of the building to reflect the chaos of nature. The lobby of the hotel features a 65-foot ceiling, a massive rhyolite fireplace, and railings made of contorted lodgepole pine. Wings were added to the hotel in 1915 and 1927.

Another historic structure is the Old Faithful Lodge. Unlike the Inn, the current Old Faithful Lodge is a result of numerous changes dating back to the early days of tent camps provided by companies like Shaw and Powell Camping Company and Wylie Permanent Camping Company. These camps were erected throughout the park and offered shelter before hotels and lodges were built. Both companies had facilities at Old Faithful. By 1917, auto traffic into the park was increasing, and it was decided that some camps could be eliminated. Yellowstone Park Camping Company emerged and operated on the old site of the Shaw and Powell camp, the present day site of the Lodge. In 1918, a laundry was built on the site and construction continued on the facility until 1928 when the Lodge reached its present configuration.

The Lower Hamilton Store was built in 1897 and is the oldest structure in the Old Faithful area still in use. The "knotty pine" porch is a popular resting place for visitors, providing a great view of Geyser Hill. (The oldest building at Old Faithful was built as a photo studio in 1897 for F. Jay Haynes. Originally located 700 feet southwest of Beehive Geyser and about 350 feet northwest of the front of the Old Faithful Inn, it now stands near the intersection of the Grand Loop Road and the fire lane, near the crosswalk.)

Midway Geyser Basin

This geyser basin, across the Firehole River from the Grand Loop Road, is smaller in size than the Upper and Lower geyser basins. Excelsior Geyser is a gaping crater 200 x 300 feet in size that constantly discharges more than 4,000 gallons of water per minute into the Firehole River. Also here is Yellowstone's largest hot springs, Grand Prismatic Spring. This feature is 370 feet in diameter and more than 121 feet in depth. Abridge across the Firehole River allows access to the basin.

Lower Geyser Basin

There are two areas to view the activity of the Lower Geyser Basin, Fountain Paint Pots (accessed by a boardwalk trail) and Firehole Lake Drive. The latter is a 3-mile, one-way drive

where you will find the sixth geyser predicted by the Old Faithful staff: Great Fountain. Its splashy eruptions send jets of diamond droplets bursting 100 to 200 feet in the air, while waves of water cascade down the raised terraces. The geyser erupts twice each day and predictions are within 2 hours (+/-) of actual eruptions.

Fountain Flats Drive, a short side road immediately south of the Nez Perce picnic area, follows the Firehole River for 1-1/2 miles to a trailhead. From there, the Fountain Freight Road hiking/biking trail continues along the old roadbed allowing hikers access to the Sentinel Meadows Trail and the Fairy Falls Trail. Also along this path is a handicapped-accessible backcountry site at Goose Lake.

Anumber of famous structures once stood in this geyser basin. The Marshall House, also known as Marshall's Hotel, this was the second hotel to be built in the park. Built by George W. Marshall in 1884, it was located near the present-day site of the Fountain Flat Drive and Grand Loop Road intersection. The hotel was later sold to a Mr. Graham and eventually purchased by the Yellowstone Park Association in 1886; it was renamed the Firehole Hotel. The hotel was torn down between 1892 and 1895. Agrave in the area of the hotel dates back to 1889 when Mattie Culver, wife of the hotel's innkeeper E.C. Culver, died from tuberculosis in March. Because the ground was still frozen, Mrs. Culver's body was placed in a barrel with the assistance of soldiers from the nearby Fountain Soldier Station. Aproper burial occurred later in the spring.

The Fountain Hotel opened for business in 1891 just a short distance south of the Marshall Hotel site in a meadow north of Fountain Paint Pots. Owned by the Yellowstone Park Association, the hotel could accommodate 350 visitors and was a pleasant addition to earlier lodging facilities. Accommodations included hot baths that tapped into nearby hot springs, a practice that was fortunately later stopped. This was one of the first Yellowstone hotels to feed bears for the entertainment of guests. The hotel was torn down in 1927.

In the fall of 1886, after the U.S. Army took over administration of the park, small detachments of soldiers were dispatched to outposts throughout the park. Stations at Nez Perce Creek (also called Fountain) and Old Faithful (also called Upper Geyser Basin) were among the first of these outposts. The Fountain Station was built "on a slight bench and about 200 feet east of the northern junction of the Fountain Freight Road and the main road through the Lower Geyser Basin." (The Old Faithful station was located on the west bank of the Firehole River opposite the Lion group of geysers.) Archeological investigations of the site have revealed foundations and some artifacts.

One structure that still stands is the Nez Perce Creek Wayside. This exhibit tells the story of the flight of the Nez Perce through Yellowstone in 1877. A band of 700 men, women, and children entered the park on the evening of August 23rd, fleeing 600 Army regulars commanded by General O.O. Howard. The Nez Perce had been told to leave their homeland and move to a reservation. They fled their ancestral home in the Wallowa Valley in northeastern Oregon on June 17, 1877, and by the time they entered the park, several battles, including a fight at Big Hole (another NPS site), had occurred. During the two weeks they were in the park, the Nez Perce bumped into all 25 known people visiting the new park at that time, some more than once. Several people were killed or wounded. After leaving the park, the Nez Perce tried reaching the Canadian border but were stopped by General Nelson Miles, who had reinforced General Howard's command. Some Nez Perce were able to slip into Canada, but the remaining 350 tribal members led by Chief Joseph surrendered to General Miles. This is where Chief Joseph gave his famous speech, "I will fight no more forever." The 1,700-mile flight that included Yellowstone National Park had come to an end. Today, Nez Perce Creek and the nearby wayside exhibit are reminders of their visit.

Shoshone Geyser Basin

Shoshone Geyser Basin is reached by a 17-mile round trip hike that crosses the Continental Divide at Grant's Pass. This basin has no boardwalks, and extreme caution should be exercised when traveling through it. Trails in the basin must be used. Remote thermal areas, such as this, should be approached with respect, knowledge, and care.

Day Hiking Trails

Geyser Hill Loop Trail: This easy, 1.3-mile loop trail gives visitors a good chance to see a variety of geysers, from the ever-entertaining Anemone with its short intervals of 5 to 10 minutes to the impressive Beehive with its unpredictable eruptions reaching 100 to 150 feet. The boardwalk begins at the Old Faithful Visitor Center.

Numerous other combination loops or one-way walks can be chosen in the Upper Geyser Basin. Features such as Castle, Grand, Riverside, and Daisy geysers along with Morning Glory Pool are easily accessed using the Old Faithful self-guiding trail map. Details on geyser prediction times may be obtained by stopping by the visitor center.

Observation Point Loop Trail: This 1.1-mile loop trail gains about 200 feet in elevation to a prominent overlook providing a great view of the Upper Geyser Basin. The trail begins at the foot-bridge behind Old Faithful Geyser.

Mallard Lake Trail: This moderately difficult, 6.8-mile (round trip) trail climbs through lodge-pole pine forest (some burned areas from the 1988 fires) and along meadows and rocky slopes before reaching at Mallard Lake. The trailhead is in the Old Faithful Lodge cabin area.

Lone Star Geyser Trail: This easy, 5-mile (round trip) trail follows an old service road along the Firehole River through unburned forests of lodgepole pine. The geyser, which erupts approximate-ly every 3 hours, puts on a delightful show. There is a logbook, located in a cache near the geyser, for observations of geyser times and types of eruptions. This trail can be accessed by bicycle with the final approach to the geyser on foot. The trailhead is 3 miles south of the Old Faithful area, just beyond Kepler Cascades parking area.

Black Sand and Biscuit Basin Trails: Both areas are accessed by easy, 1/2-mile loop boardwalks. Black Sand Basin is 1/2 mile north of the Old Faithful area and Biscuit Basin is 2 miles north. Both areas are included in the Old Faithful area trail guide.

Midway Geyser Basin Trail: The 1/2-mile loop boardwalk leads visitors by impressive features including Excelsior Geyser and Grand Prismatic Spring. The parking area is 6 miles north of the Old Faithful area.

Fountain Paint Pot Trail: Yellowstone's four types of thermal features can be seen in one easy - mile walk along this loop trail: geysers, hot springs, mudpots, and fumaroles. Atrail guide is avail-able for this area, which also includes the Firehole Lake Drive area. The parking area is 8 miles north of the Old Faithful area.

Mystic Falls Trail: This 2-1/2 -mile (round trip) trail follows a lovely creek through a lodgepole pine forest before reaching the 70-foot falls. By following a series of switchbacks, an overlook of the Upper Geyser Basin can be reached before looping back to join the main trail. The trail begins at the back of the Biscuit Basin boardwalk.

Fairy Falls Trail: At 200 feet high, Fairy Falls is an impressive backcountry sight. It can be reached from two different trailheads, both easy hikes. The first trailhead, 1 mile south of the Midway Geyser Basin, begins at a steel bridge across the Firehole River and follows the Fountain Freight Road hiking/biking trail for approximately 1 mile before the hiking-only trail to Fairy Falls branches off on the left (a total of 5 miles). The second trailhead, 1/2 mile south of the Nez Perce picnic area on the Fountain Freight Road, follows the hiking/biking path from the northern end, 1-3/4 miles to the junction with the Fairy Falls trail (a total of 7 miles).

Norris/Madison Area

Norris Geyser Basin

Norris Geyser Basin is the hottest, oldest, and most dynamic of Yellowstone's thermal areas. The highest temperature yet recorded in any geothermal area in Yellowstone was measured in a scientific drill hole at Norris: 459°F just 1,087 feet below the surface! There are very few thermal features at Norris under the boiling point (199°F at this elevation). Norris shows evidence of having had thermal features for at least 115,000 years. The features in the basin change daily, with frequent disturbances from seismic activity and water fluctuations.

Norris sits on the intersection of three major faults. The Norris-Mammoth Corridor is a fault that runs from Norris north through Mammoth to the Gardiner, Montana, area. The Hebgen Lake fault runs from northwest of West Yellowstone, Montana, to Norris. This fault experienced an earthquake in 1959 that measured 7.4 on the Richter scale (sources vary on exact magnitude between 7.1 and 7.8). These two faults intersect with a ring fracture that resulted from the Yellowstone Caldera of 600,000 years ago. These faults are the primary reason that Norris Geyser Basin is so hot and dynamic.

The vast majority of the waters at Norris are acidic, including acid geysers which are very rare. Steamboat Geyser, the tallest geyser in the world (300 to 400 feet) and Echinus Geyser (pH 3.5 or so) are the most popular features. The basin consists of three areas: Porcelain Basin, Back Basin, and One Hundred Springs Plain. Porcelain Basin is barren of trees and provides a sensory experience in sound, color, and smell; a 3/4 mile dirt and boardwalk trail accesses this area. Back Basin is more heavily wooded with features scattered throughout the area; a 1-1/2 -mile trail of boardwalk and dirt encircles this part of the basin. One Hundred Springs Plain is an off-trail section of the Norris Geyser Basin that is very acidic, hollow, and dangerous. Travel is discouraged without the guidance of knowledgeable staff members.

Periodically, Norris Geyser Basin undergoes a large-scale basin-wide disturbance. This change is manifested in water level fluctuations, temperature changes, pH changes, color changes, and eruptive pattern changes in features throughout the basin. Some features become murky; others, like Echinus Geyser, are less predictable. Geologists and water chemists have studied these disturbances, and have several theories about why they occur. Some say the disturbances are a massive fluctuation in the underground reservoirs that provide water to the basin. It is known that Norris has several water systems that supply water to various parts of the area; some call them stacked water systems. Some theorize that because the disturbance usually occurs in the fall there is less surface water mixing with water from deep underground. The water from deep underground holds more silica and clogs the cracks and crevices that supply water, thereby creating a "disturbance" as pressure builds. Exciting things happen during disturbances. For example, a small geyser, Porkchop, became a continuous jet of steam and water in 1985; during the fall of 1989, at the onset of disturbance, Porkchop clogged with silica and blew up. Rocks from the apron around the geyser flew 200 feet into the air! Disturbances usually last for a few weeks, and then the basin returns to a more "normal" state.

The Ragged Hills that lie between Back Basin and One Hundred Springs Plain are thermally altered glacial moraines. As glaciers receded, the underlying thermal features began to express themselves once again, melting remnants of the ice and causing masses of debris to be dumped. These debris piles were then altered by steam and hot water flowing through them.

The area was named for (and by) Philetus W. Norris, the second superintendent of Yellowstone, who provided the first detailed information about the thermal features. The Norris Geyser Basin Museum is one of the park's original trailside museums and was built in 1929-30. It is an outstanding example of stone-and-log architecture and is a National Historic Landmark.

Across the road from the thermal basin at the entrance to the Norris campground is the Museum of the National Park Ranger. The museum is housed in the Norris Soldier Station, one of the oldest, remaining soldier stations in the park. An earlier structure was built in 1886, but it was replaced after a fire in 1897. The building was modified in 1908. After the Army years, the building was used as a ranger station and residence until the 1959 Hebgen Lake earthquake caused structural damage. The building was restored in 1991 and adapted to its current use.

The Norris Campground area and the meadows adjacent to the Gibbon and Madison rivers are prime elk calving areas in the spring. Fall brings bull elk to these same meadows. Bison frequent the same meadows in the spring, summer, and fall and use the thermal areas a great deal in the winter season. Both black and grizzly bears pass through the Norris area, with grizzlies using the thermal areas in the spring to feed on winter-killed elk and bison. Norris is one of the few areas in Yellowstone having lizards. The sagebrush lizard can only survive here due to the influence of thermal activity. They are sensitive to disturbance and are only occasionally seen on the public trails. Chorus frogs may be heard in the area in the spring, mixing their song with the winnowing of the snipe.

The thermal areas are known for their abundant and unusual lifeforms including many species of bacteria, algae, and insects. Because Norris is acidic, some forms of life that are especially suited to life in extremes of heat and acid have been found here. *Cyanidium* (a green algae) is one of the more unusual alga found at Norris; the best locale for viewing is in Porcelain Basin in the runoff channel near Whirligig Geyser. Look for the streak that looks like lime Koolaid. Norris also has a great deal of coloration due to mineral stain, so look closely before assuming it's alive! Killdeer are found in the basin year-round taking advantage of the brine flies and other insects that carry on their lives in the warm waters.

Roaring Mountain

Located just north of Norris on the Norris-Mammoth section of the Grand Loop Road, Roaring Mountain is a large, acidic thermal area (solfatara) that contains many steam vents (fumaroles). In the late 1800s and early 1900s, the number, size, and power of the fumaroles was much greater than today.

Virginia Cascades

Athree-mile section of an older portion of the Grand Loop Road takes visitors past 60-foot high Virginia Cascades, which is part of the rim of the Yellowstone Caldera. This cascading waterfall is formed by the very small (at this point) Gibbon River. A 22-mile swath of lodgepole pine that was blown down by wind-shear action in 1984 is just beyond the entrance to the Virginia Cascades Drive. This "blowdown" was burned during the North Fork fire in 1988, and the landscape is particularly blackened and barren. (This is the site where a famous news anchor said, "Tonight, this is all that's left of Yellowstone.") Aboardwalk trail takes visitors into the middle of the blowdown and a wayside exhibit tells the story.

Artist Paint Pots Area

Artist Paint Pots is a small but lovely thermal area just south of Norris Junction. A1-mile round trip trail takes visitors to colorful hot springs, two large mudpots, and through a section of forest burned in 1988. Adjacent to this area are three other off-trail, backcountry thermal areas: Sylvan Springs, Gibbon Hill Geyser Basin, and Geyser Creek Thermal area. These areas are fragile, dangerous, and difficult to get to; travel without knowledgeable personnel is discouraged.

Monument Geyser Basin is a small, nearly dormant basin that lies at the top of a very steep 1-mile trail just south of Artist Paint Pots. Thermos-bottle shaped geyser cones are remnants of a much more active time. Just south of Artist Paint Pots, the 84-foot Gibbon Falls tumbles over remnants of the Yellowstone Caldera rim. The rock wall on the opposite side of the road from the waterfall is the inner rim of the caldera.

Madison Junction

At Madison Junction, the Gibbon River joins the Firehole River to form the Madison River. (The Gibbon River flows from Wolf Lake through the Norris area to Madison Junction. The Firehole River starts south of Old Faithful and flows through the park's major thermal basins northward to Madison Junction.) The Madison joins the Jefferson and the Gallatin rivers at Three Forks, Montana, to form the Missouri River. The Madison is a blue-ribbon fly fishing stream as is the Firehole River.

Madison Junction lies within the eroded stream channels cut through lava flows formed after the caldera eruption. National Park Mountain is actually part of the lava flows that encircle the Madison Junction area. Near this site, in 1870, the Washburn-Langford-Doane Expedition is said to have camped and discussed the future of the region they were exploring. Legend has it that this was where the idea of the national park was discussed. It should be noted that there is no evidence of the campfire conversation ever taking place, and there is certainly no evidence to show that the idea of a national park was discussed.

The Madison Museum is one of the park's original trailside museums built in 1929-30. It is an outstanding example of stone-and-log architecture and is a National Historic Landmark. Archeological digs in the campground area (and also at Norris Campground) reveal that people have camped in these areas for at least 10,000 years. Campfire remnants, obsidian flakes, and chips and bone fragments show that these campgrounds have always been favorites! The Madison area is used by bison year-round and an excellent place to view herds of the animal.

Terrace Springs lies just north of Madison Junction. There is a short boardwalk around the springs in this small thermal area. The runoff from the springs passes under the road and flows down a long slope to the Gibbon River. Yellow monkey flowers line the runoff channels in season.

Firehole Canyon Drive, a side road, follows the Firehole River upstream from Madison Junction to just above Firehole Falls. The drive takes sightseers past 800-foot thick lava flows. Firehole Falls is a 40-foot waterfall. An unstaffed swimming area here is very popular in the warmest of the summer season. Cliff diving is illegal.

Day Hiking Trails

Norris Area

Grizzly Lake: This 4-mile (round trip) trail passes through a twice-burned lodgepole pine stand (1976 and 1988) and through nice meadows. The hike is moderately difficult with some short, steep climbs. The lake is long, narrow, and heavily wooded. The lake can be difficult to access beyond the trail end of the lake because of a log jam crossing. Marshiness and mosquitos can make travel difficult early in the season. The lake is popular with anglers due to a strong population of small brook trout. The trailhead is 1 mile south of Beaver Lake on the Mammoth- Norris Road.

Solfatara Creek: The fairly easy, 13-mile (round trip) trail follows Solfatara Creek for a short distance to the junction with Ice Lake Trail; it then parallels a power line for most of the way to Whiterock Springs. It climbs a short distance up to Lake of the Woods (difficult to find as it's off trail a bit) and passes Amphitheater Springs and Lemonade Creek (don't drink it). These are small, but pretty thermal areas in the otherwise non-descript lodgepole pine forest. The trail then continues on to meet the road. There is no trail connection back to the campground except the way you came. Parking a car at both ends is desirable. This is a good place to send folks who don't want to see many other hikers, but it can be under bear restrictions so check before you send people. The trail begins in Loop C of the Norris Campground and ends 3/4 miles south of Beaver Lake Picnic Area on the Mammoth-Norris Road.

Ice Lake Trail (direct route): Ice Lake is a lovely, small lake nestled in the thick lodgepole pine forest. Some of the area was heavily burned in 1988. The easy 0.3 mile trail ends at a handicapped accessible backcountry site on the lake (some assistance may be needed to reach the lake). Hikers can continue from Ice Lake to Wolf Lake, Grebe Lake, and Cascade Lake, and then on to Canyon. The trailhead is 3-1/2 miles east of Norris on the Norris-Canyon Road.

Wolf Lake Cut-off Trail: The trail follows the Gibbon River past Little Gibbon Falls and then through dense, partially burned lodgepole pine forest to Wolf Lake. It is 1 mile to the junction with the Wolf Lake trail and about 2 miles on to the lake. The trail crosses the stream several times and may be difficult to follow due to lack of regular maintenance. The trail is accessed from the big pullout about 1/4 mile east of Ice Lake Trailhead on the Norris-Canyon Road (orange trail markers can be seen once hikers cross the road from the parking area.

Cygnet Lakes Trail: This easy, 8-mile (round trip) trail travels through intermittently burned lodgepole pine forest and past small marshy ephemeral ponds to the lush meadows surrounding

Cygnet Lakes (small and boggy). Day use only! Trail not maintained beyond Cygnet Lakes. The trailhead is the pullout on the south side of the Norris-Canyon road approximately 5.5 miles west of Canyon Junction.

Artist Paint Pots: This is one of the overlooked yet wonderful short hikes (1 mile round trip) of Yellowstone. The trail winds across a wet meadow on boardwalk then enters a partially burned lodgepole pine forest. The thermal area within the short loop at the end of the trail contains some of the most colorful hot springs and small geysers found in the area. Two mudpots at the top of the hill allow closer access than Fountain Paint Pots. Caution for flying mud! Remind folks to stay on the trail throughout the area. The trailhead is 4-1/2 miles south of Norris on the Norris-Madison Road.

Monument Geyser Basin: This 2-mile (round trip) trail is deceptively easy as it meanders along a gentle gradient following the Gibbon River, then it turns sharply uphill and climbs 500 feet in one-half mile. Footing is on eroding geyserite and rhyolite, somewhat reminiscent of ball bearings. The geyser basin is a very interesting collection of dormant cones of varying sizes; one resembles a thermos bottle! Most of the thermal activity here has ceased. The trailhead is 5 miles south of Norris just past the Gibbon River Bridge.

Madison Area

Purple Mountain: This 6-mile (round trip) trail ascends the mountain in a steady climb of 1,500 feet through intermittent burned lodgepole pine forest and ends with a nice view of the Firehole Valley and lower Gibbon Valley; some views of the Madison Junction area are also visible. The trial is close to Madison Campground, about 1/4 mile north of the junction on the Madison-Norris Road. There is limited parking.

Harlequin Lake: This easy, 1-mile (round trip) trail is a gentle ascent through burned lodgepole pines to a small, marshy lake popular with mosquitos and waterfowl (but not harlequin ducks). It is a nice, quick hike where visitors can escape the road for a little bit. The trailhead is 1-1/2 miles west of Madison Campground on the West Entrance Road.

Two Ribbons Trail: This 1-1/2 -mile (round trip) trail is a completely boardwalked and winds through burned lodgepole pine and sagebrush communities next to the Madison River. There are good examples of fire recovery and regrowth here as well as buffalo wallows. There are no interpretive signs or brochures other than the wayside exhibits at the trailheads. The unmarked trailhead is in a large pullout approximately 5 miles east of the West Entrance.

Gallatin Area

There are many excellent hiking opportunities in the Gallatin area. Most of these, however, are longer and steeper than the average day hike. They include Daly Creek, the Sky Rim, Black Butte, Specimen Creek, Crescent Lake/High Lake, Sportsman Lake, and Bighorn Pass and Fawn Pass. For more information, consult a Visitor Center or one of the hiking trail guides available from the Yellowstone Association.

Mammoth Area

Mammoth Hot Springs

Even though Mammoth Hot Springs lies outside the caldera boundary, the geothermal activity here is the result of the same magmatic system that fuels other Yellowstone thermal areas. Hot water flows from Norris to Mammoth along a fault line roughly associated with the Norris to Mammoth road. Shallow circulation along this corridor allows Norris' super-heated water to cool somewhat before surfacing at Mammoth, generally to about 170° F.

While most of the geothermal formations you see in the park are made up of sinter, the hot spring terraces are travertine. This difference is the result of the kind of rock underlying the Mammoth area, which is limestone rather than rhyolite. Travertine formations grow much more rapidly than sinter formations due to the softer nature of limestone. Hot water charged with carbon dioxide (one of the gases released from the magma chamber) forms a weak carbonic acid solution. This acidic water rises through the limestone, dissolving large quantities of rock. Once the water reaches the ground surface, some of the carbon dioxide escapes from solution and the white, chalky mineral called travertine is deposited. About two tons of travertine are deposited each day on the terraces.

Although visitors are sometimes confused by the rapidly shifting activity of the hot springs and disappointed when a favorite spring appears to have "died," it is important to realize that the location of springs and the rate of flow in various springs changes *daily*. The overall volume of water discharged by all of the springs together fluctuates little, however.

The Mammoth area has been thermally active for several thousand years, and the evidence of past thermal activity is extensive. Terrace Mountain, northwest of Golden Gate, has a thick cap of travertine. The Mammoth Terraces extend all the way from the hillside where we see them today, across the Parade Ground, and down to Boiling River. The Mammoth Hotel, as well as all of Fort Yellowstone, is built upon an old terrace formation known as Hotel Terrace. (There was some concern when construction began in 1891 on the Fort site that the hollow ground would not support the weight of the buildings, but construction proceeded). Several large sink holes (fenced off) can be seen on the Parade Ground.

The Mammoth area also exhibits much evidence of glacial activity from the Pinedale Glaciation. The summit of Terrace Mountain is covered with glacial till, thereby dating the travertine formation there to earlier than the end of the Pinedale Glaciation (15,000 years ago). Several thermal kames, including Capitol Hill and Dude Hill, are major features of the Mammoth area. Ice-marginal stream beds are in evidence in the small, narrow valleys where Floating Island Lake and Phantom Lake are found east of Mammoth. In Gardner Canyon, one can see the old, sorted gravel bed of the Gardner River covered by unsorted glacial till.

Mammoth is much lower in elevation than the rest of the park, and has always been used by elk during winter. Today, however, elk are found in the Mammoth area year-round, a result of the development. In the summer, herds of cows and calves will congregate here to forage on the well-watered lawns. In the fall during the rut, the bulls will also move in and congregate on the lawns. There have been many close calls and some accidents because visitors approach the elk too closely thinking they are tame. Besides the ample supply of forage, the development offers elk refuge from their natural predators, including bears, coyotes, mountain lions, and (now) wolves. Rivaling the elk in numbers, Uinta ground squirrels form a large colony every summer in front of the visitor center and among the hotel cabins.

Fort Yellowstone

All of the red-roofed, many-chimneyed buildings in the Mammoth area are part of historic Fort Yellowstone. In 1886, after 14 years of inadequate civilian management of the park, the U.S. Army was called upon to manage the park's resources and visitors. Atroop of calvary was ordered to Yellowstone. Because the military only expected to be in Yellowstone a short while, they built a temporary post near the base of the Mammoth Terraces called Camp Sheridan. After five cold, harsh winters, it was apparent that tents were not sufficient to house the troop and construction

began on Fort Yellowstone, a permanent post.

The first building constructed (in 1891) was the guard house, which directly related to the Army's mission—protection and management of the park and its visitors. There were three stages of construction at Fort Yellowstone. The first set of clapboard buildings were built in 1891; the second set in 1897 when the military expanded to a two-troop fort. Finally, in 1909, the stone buildings were built. The military contingent assigned to Yellowstone was now 400 men or four troops. In 1916, the National Park Service was established, and the Army returned control of Yellowstone to civilians. However, the civilian NPS could not be organized quickly enough and the Army returned in 1917; their duty was finally completed in 1918. Fort Yellowstone is one of the best remaining examples of a 1900-era cavalry post. All of the buildings are adaptively used by the NPS today. The Albright Visitor Center and Museum was the bachelor officers' quarters during the military era.

There are many historic structures in the Mammoth area besides the Fort Yellowstone structures, including the Mammoth Hotel, which is actually the remaining wing of one of the early Mammoth Hotels; the Engineer's office ("Pagoda"), designed in 1903 by Hiram Chittenden of the U.S. Army Corps of Engineers; the Scottish Rite Chapel, 1913, still used today for religious services and is the site of many weddings; Reamer House, designed in 1908 by well-known architect Robert Reamer, an example of Prairie-style architecture; and the Haynes Picture Shop, photographic studio used by the Haynes family.

Roosevelt Arch

The first major entrance for Yellowstone was at the north boundary. Before 1903, trains would bring visitors to Cinnabar, Montana, which was a few miles northwest of Gardiner, Montana, and people would climb onto horse-drawn coaches there to enter the park. In 1903, the railway finally came to Gardiner. Robert Reamer, architect of the Old Faithful Inn and other structures in Yellowstone, designed an immense stone archway for coaches to travel through on their way into the park. At the time of the arch's construction, President Theodore Roosevelt was visiting the park and he officially placed the cornerstone for the arch. The Arch was subsequently named for him. The top of the Roosevelt Arch is inscribed with the phase, "For the benefit and enjoyment of the people," which is taken from the Organic Act of 1872, the enabling legislation for Yellowstone National Park.

45th Parallel Bridge & Boiling River

Asign near where the road crosses the Gardner River marks the 45th parallel of latitude. The 45th parallel is an imaginary line that circles the globe halfway between the equator and the North Pole. This same line passes through Minneapolis-St. Paul; Ottawa, Ontario, Canada; Bordeaux, France; Venice, Italy; Belgrade, Yugoslavia; and the northern tip of the Japanese islands. Here in Yellowstone, the line marks the Montana-Wyoming border.

Aparking area on the east side of the road is used by visitors who walk to the "Boiling River." Bathers must walk upstream about a half mile from the parking area to the place where the footpath reaches the river. This spot is also marked by large clouds of steam, especially in cold weather. Here, a large hot spring, known as Boiling River, enters the Gardner River. While it is illegal to bathe or soak in any hot spring in the park, use is allowed here where the hot and the cold water mix in pools along the river's edge. Bathers are allowed in the river during daylight hours only. Bathing suits are required, and no alcoholic beverages are allowed. Boiling River is closed in the springtime due to hazardous high water and often does not reopen until mid-summer.

Mt. Everts

Mt. Everts was named for explorer Truman Everts, the member of the 1870 Washburn Expedition who became separated from his companions, lost his glasses, lost his horse, and spent the next 37 days starving and freezing and hallucinating as he made his way through the untracked and inhospitable wilderness. Upon rescue, he was, according to his rescuers, within but a few hours of death. Everts never made it quite as far as Mt. Everts. He was found near the "Cut" on the Blacktail Plateau Drive and was mistaken for a black bear and nearly shot. His story, which he

later published in *Scribner's Monthly Magazine*, remains one of Yellowstone's best known, lost-in-the-wilderness stories.

Mt. Everts, 7,841 feet high, is a long ridge northeast of Mammoth. It is made up of distinctly layered sandstones and shales—sedimentary rocks deposited when this area was covered by a shallow inland sea, 70 to 140 million years ago.

Bunsen Peak

Bunsen Peak and the "Bunsen burner" were both named for the German physicist, Robert Wilhelm Bunsen. Although most people are familiar with the "Bunsen burner," few people know why his students gave the burner that name. He was involved in pioneering research about geysers, and a "Bunsen burner" has a resemblance to a geyser. His theory on geysers was published in the 1800s, and it is still believed to be accurate.

Bunsen Peak is 8,564 feet high and may be climbed via a trail that starts at the Golden Gate. Another trail, the Bunsen Peak road (which is now closed to autos), skirts around the flank of the peak from the YCC camp to the Golden Gate. This road may be used by hikers, bicyclists, and, in winter, cross-country skiers. The peak is also interesting because it burned in the 1880s and then again in 1988. Aseries of old photos show the creep of trees up Bunsen following the 1880 fires, and the new patterns of open space created by the fires of 1988.

South of Bunsen Peak is Swan Lake Flats, a large open expanse of meadows where visitors often see herds of elk and bison. Grizzly bears are also seen here at times. Swan Lake is an excellent spot for birders to see swans, ducks, herons, cranes, shore birds, and a variety of sparrows (in season. Beyond Swan Lake Flats is Willow Park where moose are often spotted.

Obsidian Cliff

Obsidian Cliff is located 11 miles south of Mammoth Hot Springs and rises 150 to 200 feet above Obsidian Creek. Obsidian is created when lava cools so quickly that it does not have time to form crystals. Amassive outcrop the size of Obsidian Cliff is quite rare because obsidian is usually found as small sections of other rock outcrops. Obsidian Cliff probably formed because the molten rock that erupted from the earth had very little water in it. The absence of water discourages the nucleation of atoms and causes faster cooling. Obsidian can be dated by measuring the hydration rate (absorption of water) of the rock. Because there are so few sources of obsidian in the world, matching a projectile point to a particular outcrop of obsidian is fairly easy.

For centuries, many Native Americans made their projectile points from obsidian. The rock itself is dark and glassy in appearance and, when broken, fractures into round pieces with sharp edges. Projectile points found as far away as Ohio have had their origin traced back to the Obsidian Cliff area. Tracking obsidian from Yellowstone to the Midwest indicates that the quality of obsidian found here was very good. In 1996, Obsidian Cliff was named a National Historic Landmark. The historic wayside exhibit here is one of the first of its kind in Yellowstone, built in the 1920s.

Day-Hiking Trails

Beaver Ponds Loop Trail: This moderately difficult, 5-mile loop trail follows the creek up Clematis Gulch, climbing 350 feet through Douglas-fir trees. The beaver ponds are reached after hiking 2-1/2 miles through open meadows of sagebrush and stands of aspen. Elk, mule deer, pronghorn, moose, beaver dams and lodges, and the occasional beaver and black bear may be sighted in the area. There are spectacular views as you wind your way back to Mammoth. The trail begins between Liberty Cap and the stone house (the Judge's house) next to the Mammoth Terraces.

Bunsen Peak Trail: This moderately difficult trail gradually climbs 1,300 feet to the summit of Bunsen Peak. From here there is a panoramic view of the Blacktail Plateau, Swan Lake Flats, Gallatin Mountain Range, and the Yellowstone River Valley. It is a 2 mile climb to the summit. Return by the same route or take the trail down the back side of the mountain to Osprey Falls trailhead (about 2 miles) and return via the Bunsen Peak Road (now closed to automobiles). Osprey Falls is an additional 2.8 miles (see below). The trail begins at the gate across the Bunsen Peak

Road, 5 miles south of Mammoth (toward Norris).

Osprey Falls Trail: The 8-mile (round trip) trail follows the Bunsen Peak Road (now closed to automobiles) for 2-1/2 miles through grassland and burnt forest. The Osprey Falls trail veers off the road and follows the rim of Sheepeater Canyon before descending in a series of switchbacks to the bottom of Sheepeater Canyon (this portion of the trail results in a rating of difficult for this hike). The Gardner River plunges a 150 feet forming Osprey Falls. Vertical cliffs rise 500 feet above you, making it one of the deepest canyons in Yellowstone. The trail begins at the gate across the Bunsen Peak Road, 5 miles south of Mammoth (toward Norris).

Lava Creek Trail: This moderately difficult, 3-1/2 -mile (one way) trail follows Lava Creek downstream past Undine Falls (50 feet), descending gradually. Lava Creek meets the Gardner River farther downstream. The trail crosses a foot bridge on the Gardner River, and there is one final ascent to a pullout on the North Entrance Road just north of the Mammoth Campground. The trail begins at the Lava Creek picnic area on the Mammoth-Tower Road.

Rescue Creek Trail: This moderately difficult, 8-mile (one way) trail follows the Blacktail Deer Creek trail for the first 3/4 mile until meeting Rescue Creek trail. The trail climbs gradually through aspens and open meadows before beginning a 1,400 foot descent to the Gardner River. The trail crosses a foot bridge over the river and ends 1 mile south of the North Entrance Station. The trail begins at the Blacktail Trailhead 7 miles east of Mammoth on the Mammoth-Tower Road.

Sepulcher Mountain Trail: This strenuous, 11-mile loop trail follows the Beaver Ponds Trail to the Sepulcher Mountain Trail junction. This trail rises 3,400 feet through pine trees and open meadows until the 9,652 foot summit of Sepulcher Mountain is reached. To complete the loop, continue along the opposite side of the mountain through a broad open slope to the junction of the Snow Pass Trail. Continue down until you reach the junction with the Howard Eaton Trail. This will lead you west of the Mammoth Terraces and back to your original trailhead at Clematis Gulch between Liberty Cap and the stone house (Judge's house).

Wraith Falls: This short (1 mile round trip), easy hike takes you through open sagebrush and Douglas-fir forest to the foot of Wraith Falls cascade on Lupine Creek. The trailhead is the pullout 1/4 mile east of Lava Creek Picnic area on the Mammoth-Tower Road.

Blacktail Deer Creek-Yellowstone River Trail: This moderately difficult, 12-1/2 -mile trail follows Blacktail Deer Creek as it descends 1,100 feet through rolling, grassy hills and Douglas-fir forest until it reaches the Yellowstone River. The trail continues across the Yellowstone River on a steel suspension bridge and joins the Yellowstone River Trail. The trail continues downriver, passing Knowles Falls and into arid terrain until it ends in Gardiner, Montana. The trail begins at the Blacktail Trailhead, 7 miles east of Mammoth on the Mammoth-Tower Road.

Tower Area

The geology of the Tower area is incredibly varied. Major landforms are expressions of geologic events that helped shape much of the Yellowstone area. Mt. Washburn and the Absaroka Range are both remnants of ancient volcanic events that formed the highest peaks in the Tower District. Ancient eruptions, perhaps 45 to 50 million years ago, buried the forests of Specimen Ridge in ash and debris flows. The columnar basalt formations near Tower Fall, the volcanic breccias of the "towers" themselves, and numerous igneous outcrops all reflect the area's volcanic history.

Later, glacial events scoured the landscape, exposing the stone forests and leaving evidence of their passage throughout the district. The glacial ponds and huge boulders (erratics) between the Lamar and Yellowstone rivers are remnants left by the retreating glaciers. Lateral and terminal moraines are common in these areas as well as in the Hellroaring and Slough creek drainages, on Blacktail Plateau, and in the Lamar Valley.

In the Lamar River Canyon lie exposed outcrops of gneiss and schist which are among the oldest rocks known in Yellowstone, perhaps more than two billion years old. Little is known about their origin due to their extreme age. Through time, heat and pressure have altered these rocks from their original state, further obscuring their early history. Only in the Gallatin Range are older outcrops found within the boundaries of the park.

The (relatively) low elevation valleys of the Yellowstone and Lamar rivers provide critical winter range to some of the largest wild herds of bison and elk found in North America. Due to the large herds of wintering bison and elk, the Lamar Valley was chosen as the site for reintroduction of gray wolves into Yellowstone in 1995 after a nearly 60 year absence. Historic accounts indicate that wolves inhabited nearly all portions of the district, especially the Lamar Valley and Hellroaring Creek drainages. Multiple wolf pack territories currently exist in this prime habitat.

Both grizzly and black bears are sighted throughout the area, particularly in the spring. The Antelope Creek drainage on the east slopes of Mt. Washburn is notable for having a high density of grizzly bears, particularly in the spring when elk are calving. From pullouts on the Dunraven Pass road, visitors have an excellent platform from which to view grizzlies.

Tower Fall

Tower Creek drops 132-feet at Tower Fall, which is framed by eroded volcanic pinnacles. The idyllic setting has inspired numerous artists, including Thomas Moran. The nearby Bannock Ford on the Yellowstone River was an important travel route for early Native Americans to access the buffalo plains east of the park from the Snake River plains in Idaho as well as for early European visitors and miners. It was extensively used from approximately 1840 to 1876. Alengthy portion of the trail extends through the Tower area from the Blacktail Plateau (closely paralleling or actually covered by the existing road) to eventually where it crosses crossing the Yellowstone River at the Bannock Ford upstream from Tower Creek.

Calcite Springs

This grouping of thermal springs along the Yellowstone River signals the downstream end of the Grand Canyon of the Yellowstone. The geothermally altered rhyolite inspired the artist Moran; his paintings of this scene were among those presented to Congress in 1872, leading to the establishment of the park. The steep, columnar basalt cliffs on the opposite side of the river from the overlook are remnants of an ancient lava flow, providing a window into the past volcanic forces that shaped much of the Yellowstone landscape. The gorge and cliffs provide habitat for numerous wildlife species including bighorn sheep, red-tailed hawks, and osprey.

Roosevelt Lodge

The Roosevelt Lodge was constructed in 1920 and has been determined eligible for the National Register of Historic Places. The Roosevelt National Historic District also includes the Roosevelt cabins. Interestingly, one of the reasons Roosevelt Lodge was nominated for the National Register was due to its important role in early park interpretation. The nearby Tower Ranger Station is a

remodeled reconstruction of the second Tower Soldier Station, which was built in 1907. Pleasant Valley is across the road from the Roosevelt Lodge area. It was the sight of "Uncle John" Yancey's Pleasant Valley Hotel, one of the earliest lodging facilities in Yellowstone. The hotel and outbuildings were built between 1884 and 1893 and served early park visitors as well as miners passing through en route to the mining district near Cooke City. Currently, the site is used by the concessioner for their "Old West" cookouts. None of the original buildings remain.

Specimen Ridge

Specimen Ridge, located along the Northeast Entrance Road east of Tower Junction, contains the largest concentration of petrified trees in the world. There are also excellent samples of petrified leaf impressions, conifer needles, and microscopic pollen from numerous species no longer growing in the park. The Petrified Tree, located near the Lost Lake trailhead, is an excellent example of an ancient redwood, similar to many found on Specimen Ridge, that is easily accessible to park visitors. The interpretive message here also applies to those trees found on Specimen Ridge.

The Buffalo Ranch

The Lamar Buffalo Ranch was built in the early part of the century in an effort to increase the herd size of the few remaining bison in Yellowstone, preventing the feared extinction of the species. Buffalo ranching operations continued at Lamar until the 1950s. The valley was irrigated for hay pastures, and corrals and fencing were scattered throughout the area. Remnants of irrigation ditches, fencing, and water troughs can still be found. Four remaining buildings from the original ranch compound are contained within the Lamar Buffalo Ranch Historic District (two residences, the bunkhouse, and the barn) and are on the National Register of Historic Places. In the early 1980s, old tourist cabins from Fishing Bridge were brought to Lamar to be used for Yellowstone Institute classes. In 1993, the Yellowstone Association funded the replacement of the old cabins with new insulated and heated structures. The facility is also used in the spring and fall for the Park Service's residential environmental education program, Expedition: Yellowstone!

The Northeast Entrance Ranger Station

The Northeast Entrance Ranger Station was constructed in 1934-35 and is a National Historic Landmark. its rustic log construction is characteristic of "parkitecture" common in the national parks of the west during that period.

Day-Hiking Trails

Lost Lake: This 4-mile loop trail offers views of Lost Lake, waterfowl, wet meadows, sagebrush hilltops, wildflowers, and quite often black bears. Parts of the trail are used by horse parties. For your safety when meeting horses, we recommend you move to the downhill side of the trail and remain still until they have passed. The trail begins behind the Roosevelt Lodge and climbs 300 feet onto the bench. Here the trail joins the Roosevelt horse trail and continues west to Lost Lake. (If you take the trail east, you loop back to the Roosevelt corrals on the horse trail or continue on to Tower Fall Campground.) From Lost Lake, the trail follows the contour around the hillside to the Petrified Tree parking area. Cross the parking lot and climb the hill at its northeast end to loop back behind Tower Ranger Station. Cross the creek and return to the Roosevelt Lodge cabins.

Garnet Hill Loop Trail: The Garnet Hill Loop Trail is 7-1/2 miles long. To access the trail, park in the large parking area to the east of the service station at Tower Junction. Walk down the road toward the Northeast Entrance Road (approximately 100 yards) and head west on the dirt stagecoach road about 1-1/2 miles to the cookout shelter. Continue north along Elk Creek until nearly reaching the Yellowstone River. Here the trail divides, with the west fork joining the Hellroaring Trail and the east fork continuing around Garnet Hill and eventually returning to the Northeast Entrance Road where it is a short walk back to Tower Junction.

Hellroaring Trail: The Hellroaring Trail is strenuous and can be reached from the fork of Garnet Hill Trail (see above) or you can start from the Hellroaring parking area 3.5 miles (5.6 km) west of Tower Junction. Follow the trail over the Yellowstone River Suspension Bridge, across a sagebrush

plateau, and drop down to Hellroaring Creek. The Yellowstone River and Hellroaring Creek are both popular fishing areas. Note: This trail can be hot and dry during the summer months. Please remember to take water! Also, watch your footing if you go off-trail and onto the smooth river boulders along the Yellowstone River. If you hike to Hellroaring Creek and back via the Garnet Hill Loop Trail, the hike is 10 miles round trip. If you hike to Hellroaring Creek and back via the Hellroaring Trail, the hike is 4 miles round trip

Yellowstone River Picnic Area Trail: This often overlooked trail (3.7 miles round trip) along the east rim of the Yellowstone River offers views of the Narrows of the Yellowstone, the Overhanging Cliff area, the towers of Tower Fall, basalt columns, and the historic Bannock Ford. Tower Fall itself is not visible, but the store and highway across the river can be seen for reference purposes. The trail ties into the Specimen Ridge Trail above the Bannock Ford. (Continue up to Specimen Ridge only if you are prepared for a longer hike with few trail markers.) Begin at the Yellowstone Picnic Area (1-1/4 miles northeast of Tower Junction on the Northeast Entrance Road). The trail will end at the Specimen Ridge Trailhead where you will then walk west along the road for 0.7 miles back to the Yellowstone River Picnic Area. Watch for bighorn sheep along this trail but please don't approach them! Use caution along the river canyon with its steep dropoffs.

Slough Creek Trail: This is both a scenic walk and a fishing trail, a favorite of catch-and-release anglers from around the country. The trail follows a historic wagon trail up Slough Creek through several meadows and over Plateau and Elk Tongue creeks. From the trailhead, the trail switchbacks up a moderately steep trail and rejoins Slough Creek at the first meadow (2 miles one way). (If you go on to the second meadow, it is 5 miles, one way.) While wildlife do not abound in this meadow during the summer, moose are commonly seen. Grizzly and black bears also use this valley. As on all Yellowstone trails, be alert for the possibility of bears in the backcountry. You may encounter the horse-drawn wagons of Silver Tip Ranch, a private ranch north of the park boundary that has a historic right of access. The trail begins near the vault toilet on the road to Slough Creek Campground. It is moderately strenuous for the first 1-1/2 miles, then easy.

Mt. Washburn Trail: The hike to the top of Mt. Washburn is one of the most popular hikes in Yellowstone. Two trails, each 3 miles in length (one way), switchback to the summit where expansive views of much of Yellowstone unfold below on clear, summer days. An enclosed observation area allows you to get out of the wind. Bighorn sheep are seen quite frequently during the summer on the upper parts of the trails. Harsh alpine conditions contribute to short growing seasons for the fragile alpine vegetation on the mountain. Please stay on the trails and do not approach sheep or other wildlife to help preserve the wildness of this area. The northern trail begins at the Chittenden Road parking area, 8.7 miles south of Tower Junction. The southern trail begins at Dunraven Pass parking area, 13.6 miles south of Tower Junction. More parking is available at the Chittenden Road Trailhead, although hikers using this trail may encounter bicycles and occasionally vehicles accessing Mt. Washburn for maintenance purposes.